ELECTRICITY AS A PROTECTION IN BATTLE.

Experiments Recently Conducted in Switzerland Show That Bullets May Be Deflected From Their Course By Electricity as Much as 75 Feet at 275 Yards, Rendering It Possible Thus to Shield a Body of Troops or a War Vessel From the Missiles of the E nemy.

Some experiments recently made in Switzerland open up an entirely novel field of military operations, and may lead to developments in the way of defensive tactics of an utterly revolutionary character. The experiments show the possibility that electricity may in future beutilized to deflect bullets from their intended course, thus rendering the aim of the most expert marksman altogether ineffectual.

The discovery of this vastly important power of electricity over a flying missile was made quite by accident. The committee of the federal shooting association of Switzerland, while target shooting at Winterthur, noticed that targets at the left side of the range received a majority of bullets to the left of the bullseye, while the reverse was the case on the other side of the range. Some quick-witted member of the committee suggested that this apparent deflection of the missiles might be due to the electric telephone wires which chanced to be strug on either side of the range. The matter was brought to the attention of the federal experimental committee, who found that all projectiles that had been deflected from their course were magnetized.

The theory of electrical action being thus supported, experiments were undertaken to put the question to a final test. At the range near Shun, where no electric wires were in the way, four experimental wires, each 18 mm in diameter, were strung parallel to the line of fire, and 125 feet away from it. Paper screens were then fixed at intervals of 30 feet along the range, to indicate the exact course of the bullets. An electric current of 8,000 volts being sent through the wires, its influence was unmistakably shown by the course of the bullets fired from the military rifles. At 275 yards the deflection of the bullet from the straight course was no less than 75 feet, "the trajectory, as marked by the paper screens, showing a very remarkable curve toward the wires.

When a trial was made with a Japanese rifle, the invention of Colonel Yamsgate, which throws a very slender bullet, the results were even more startling, as the "minute bullet went straight for the wires, broke two insulators, and followed along the course of the electric wires, finally wearing out its energy with the friction."

The effect thus being more pronounced with small missiles, it was presumed that a connon ball would be unaffected. But a trial proved this assumption a mistake, for on a 3,000-yard range, the wires being strung only for a distance of 200 yards in front of the target, and at the same lateral distance as before, the cannon ball was deflected no less than 14 degrees. With shrapnel (an explosive shell filled with musket balls), the effects were even more curious, as the projectile carrying the fuse made of non-magnetic metal was completely detached, while the body was attracted by the current, "the bullets, after the shell burst, showing such extraordinary variations that all accuracy of fire was totally done away with."

The general result of the entire series of experiments was to show that, as might be expected, the deflecting power of the current was proportionately less when large missiles were used, and varied also with the velocity of the missiles. The conclusion was reached that it would be feasible to protect an entire section of troops from hostile rifle fire at a distance of 30 yards by means of an electric current generated by a dynamo or accumulator at one side; and that at 900 to 1,400 yards even artillery would be thus rendered harmless.

It seems doubtful, however, whether such an application of the current as that here suggested could ever be of use in actual warfare, unless under very unusual circumstances, since lines strung at one side of a section would be too far removed from the bullets on the other side to sufficiently influence their flight. What apparently might be done, however, would be to have the wires strung along the earth between the opposing forces, in order to ground the bullets. The wires being strung near the line to be protected would affect the partially spent balls of the enemy more than those of the protected soldiers, and the latter could, in addition, make allowance for the current in aiming. Should the enemy see that their shots are falling low, and make allowance for the deflection, the current of electricity could, of course, be varied or altogether shut off for the moment, thus releasing the projectiles, and allowing them to fly harmlessly overhead, the change in current being from time to time announced to the protected line by signals, that their own fire might be governed accordingly. By repeated variations of the current it is evident that the aim of the most expert marksmen would be made a matter of mere guesswork. It would indeed be a strange sight should it come to pass that an enemy might stand out in an open field and be protected from the enemy's fire by an invisible breastwork of electro-magnetic force, yet this seems to be within the possibilities. Mark Twain imagined his Connecticut Yankee in "King Arthur's Court," protecting himself from his armored foes by surrounding his stronghold with an electric fence; but now truth promises to outrun the fancy of the romancer.

Perhaps the most interesting suggestion of the Swiss experiments, however, is the new element they introduce into the old controversy of projectiles vs. armor plate. Just at the moment the projectiles were in the lead, for the Johnson 100-pound ball, protected by a cap of soft steel, had penetrated ten inches of nickel steel, notwithstanding its Harveyized surface of diamond-like hardness. But now the Swiss experiments make it clear that the difficulty in future may not be so much to penetrate armor, as to hit it at all. Suppose an unarmored cruiser, built for speed, were to make a running fight with a warship, might she not pay out electric cables in her wake, and thus protect herself by deflecting the missiles of her pursuer, while at the same time bringing her own guns to bear with telling effect?

Even more easily a fort might be thus protected, for here the dirigible fish-like torpedo boats already in use (which are directed in their course by means of electricity operated from the shore) might be made to carry the deflecting current in any desired direction. So it may chance that the battle between armor and projectile will be won by the armor in an altogether unexpected way. Should the Swiss experiments be verified and extended, it seems not unlikely that all the recent advances in the long-range efficiency of firearms will be rendered nugatory by the nineteenth century wizard, electricity. Certain it seems that some utterly novel problems will be presented to the students of scientific warfare.

A LAMP WICK MADE OF CLAY.

One That Does Not Need to Be Trimmed.

A remarkable lamp wick has been invented which is made entirely of clay. This sounds paradoxical, for clay is not a substance that is very susceptible to heat, yet there is no other material in the wick except clay, and it burns in a brighter flame and gives a steadier light than any cotton wick. This new wick is made of potter's clay, and is perforated by very minute holes, up through which the oil passes by capillary attraction. In shape it is similar to the old cotton affair—flat or cylindrical. When in a plastic state, filaments of unspun vegetable fibre are mixed into the clay, and when this wick is burnt or "fired," it hardens, while the vegetable matter is consumed, leaving numerous small holes up through which the oil readily passes. This wick does not need to be trimmed. When made it is filed off square at the top, so as to cause it give a well formed flame. As the oil has a perfect passage up to the flame, it cannot emit an odor. Its inventors claim that its consumption of oil is but one-third that of the cotton wick, while producing the same amount of light.

CONDITION OF THE EARTH'S INTERIOR.

Latest Determination of the Scientists Are That the Globe Upon Which We Live is Solid to the Core, and Its Density 5.505 as Compared With Water.

Until very recent years the fact had hardly been questioned that by far the greater part of the earth's interior was in the condition of a fluid or molten mass, the volcanic manifestations exhibited on the surface, the rapid rise of temperature that is found as we proceed from the exterior to the interior, and other considerations pointing almost irresistibly to such a conclusion. Indeed, a common belief was that all that was solid centered in a crust of some 50-100 miles' thickness, "floating" on the fiery magma of the interior. It is true that some physicists as Hopkins, had reasoned out a probability that this crust, to withstand the strains that were imposed upon it, could not have a thickness of much less than 500 or 1,000 miles, but his arguments had comparatively little effect toward dispelling the nations that had so long existed. At the present time, after the brilliant mathematical exposition of Sir William Thomnson, (Lord Kelvin), of Professor George Darwin, of Professor Simon Newcomb and of Mr. Rudski, this doctrine of terrestrial fluidity is hardly longer taught. A few there are who yet linger with the old theory, but the great mass of educators and their pupils—except in regions where text-books bear the impress of manufacture in the mental power of a quarter of a century ago, or more—have settled down to the comfortable conviction that our planet is as solid or rigid as a ball of glass or steel—in fact, twice as rigid according to the determinations of M. Rudski. The doctrine of solidity does not, however, involve the assumption of equal, but of average, rigidity. Again, it is not implied that because the earth is virtually solid to the core local areas of liquidity or fluidity do not exist. It is upon these "pockets" or areas of molten material, theoretically assumed to exist, that the geologist largely relies to harmonize his facts (concerning earth movements, etc.), with those of the mathematical physic; they are to the entire mass of the earth what the air spaces are to a block of ice. Assuming the virtual solidity of the earth, the interesting question suggests itself: What is the nature of the rock masses that compose the interior? An answer to this question is largely one of inference only. We know the rocks of the exterior, and we know the rocks of the interior to a limited depth. Can our knowledge of these rocks be made to answer the inquiry as to the nature of the rocks of the deep interior?

It is, perhaps, too early to give reply to this inquiry, but the interesting fact has long been known that the average density of the earth is nearly or quite double that of ordinary rock, such as limestone, sandstone or granite, and it is assumed that its greatest density cannot easily be less than from five to ten times that of its superficial materials, or 20 times the density of water. This being so, the rocks of the interior are either compressed to a prodigious degree to give them this weight, or they are of a different character from those of the surface, possibly containing great quantities of metal. In relation to this inquiry a knowledge of the exact density of the earth becomes of first importance, and it is of special interest to note that an extended series of recalculations, made by Richarz and Kriger-Menzel, extending back to the year 1884, and with final results recently announced to the Berlin academy of sciences, confirm within a very narrow margin the earlier results obtained, with less refined instruments, by Cavendish and his successors, through a period of upwards of 100 years; these latest determinations fix the density of our planet at 5.505, (compared with water.)

A. HEILPRIN.

DRUNKENNESS AMONG INSECTS.

Recent Observation Among Scientists

The question has frequently been asked, by laymen as well as scientists, to what extent, if any, are the habits and sensations that we associate with the higher animals, especially man, a part of the being also of the lower organisms. In the earlier days of the cultivation of natural history, and one need hardly go farther back than 50 years, the distinction between man and other animated organisms was considered to be so finely and absolutely marked as to lead to an almost complete divorce of his sensations and perceptions from those of all other living matter; he was endowed with special attributes which belonged nowhere else; he was possessed of a faculty and reasoning power which were denied to his less favored associates of the living world; he alone had real intelligence, while everything below him had as the highest expression of will only instinct. In the classifications of a somewhat earlier period he was considered the type distinctive of "man," while everything below him in organization was animal. The great majority of the non-scientific thinking world perhaps even today reflect the minds of the older naturalists, and surely they did before the great revolution in thought which followed, within a few years, the appearance (in 1859) of Mr. Darwin's epoch-making work, "The Origin of Species." From that time on an almost endless series of facts have been gathered by busy observers upon the habits and mental qualities of animals, only to prove that man's isolation is only a comparative one, and that what he possesses and exercises mentally is similarly possessed, although in an inferior degree, by organisms which progressively descend lower and lower in the animal series. Instinct and intelligence are properties that belong to both high and low; natural love, the sense of shame or remorse, and the esthetic appreciation of form and color are likewise qualities that in one form or another find expression with both classes, and even that most morbid sense—the sense that sees the proper termination to life's turmoils in suicide—has been shown by Lloyd Morgan and others to find its development among certain animals, the spiders and scorpions for example. The latest contribution to the personal habits of animals has just been made by M. J. Lloyd Williams, and curiously enough it deals with the "drunken habits" of certain bumble bees. He shows that these insects, in frequenting the crowded flowers of some of the composites, as cardnus and centaures, and of a species of scabiosa, become infected with their honey to a state of intoxication by rolling on the back, striking the legs wildly in the air and general helplessness. The bees rapidly recover from these effects, but, strange though it may appear, they eagerly renew the debauch. One individual, however, as Mr. Williams informs us, manifested the next morning a praiseworthy remorse and disgust, "raising its head and forelegs as high as it could above the plants, then precipitately hurrying away as soon as released." The most delicate species was a neuter bee of the species bombus lapidarius.

A. HEILPRIN.

PORTRAITS IN DUST.

Wonderful Pictures Composed Entirely of Dust Deposited by Electricity in the Air.

The most remarkable portrait in the world is owned by a New Yorker. It is a photograph of a man, and is composed of fine particles of dust deposited on a pane of glass. It is not the handiwork of man. It is a natural phenomenon. It formed itself out of the flying dust of the atmosphere, which adhered to the glass in varying thicknesses until a perfect likeness of a living human being was produced. It required eight years for completion, yet so delicate is it that all this wonderful production of nature may be wiped away and totally obliterated by the simple rubbing of the finger tip. Many theories have been advanced explaining the cause of the formation. Several leading scientists have concluded that it was caused by atmospheric electricity, generated by the action of the sun rays shining against an old portrait.

It is probable that many persons have possessed dust portraits for years without being aware of the fact. It is also possible for any person to make dust pictures, not as elaborate as the one mentioned above, perhaps, but fairly good representations, nevertheless. The science of dustography, as it might aptly be called, owes its discovery to an accident. W. J. Hammer, the electrical expert, happened one day to observe a photographer remove an old photograph from its frame. When the pane of glass which had rested in front of the picture was held up to the light, it was found that a photograph, or tracing, the same in every respect as the original picture, was printed in dust on the glass. The phenomenon was not due to the pressure of the old photograph on the glass, for the two had been separated by a mat to the extent of one-sixteenth of an inch. Besides, the dust picture could be rubbed off the glass by pressing the fingers against it, and it yet bears the finger marks of persons who have thus tested its vulnerability. How did it happen to come there? Scientists puzzled over it for a long while, but could not solve the problem. Then it was agreed that it must be due to the action of the electricity in the air, generated by sunlight.

HOW ELECTRICITY AFFECTS OLD PICTURES.

Certain objects under the action of direct sunlight anr constantly giving off electric currents. Different parts of the same object give off currents of various strength. For instance, the dark parts of a picture emit a greater electric flow than the light portions. In the above dust picture hardly any dust remained on the glass opposite the dark surface of the old photograph. The darker the surface, the less dust there was opposite to it; the lighter the surface, the more dust there was opposite to it. This was because the heavy currents emitted from the dark surfaces scattered the dust which attempted to settle on the glass in front of them. The weak currents emitted from the lighter portions of the picture permitted dust to settle on the glass in more or less quantity. Thus the currents coming from the several parts of the picture scattered the dust, which settled on the glass according to their strength, and therefore made a perfect copy on the glass of the original picture behind it. This went on for eight years before the perfect portrait was formed. Such pictures are liable to be formed in any household, therefore persons possessing old glass-covered photographs which may have hung in direct sunlight, should remove the glass and examine it carefully to see if any electric dust pictures have been formed. The pictures will be found naturally on the inner side of the glass. They resemble a daguerrotype in appearance and when discovered should immediately be placed between two glass plates to prevent the picture being rubbed away by the fingers of careless observers.